
Bay Area Freeway Concept of Operations



Action Plan

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EXECUTIVE SUMMARY

The Metropolitan Transportation Commission (MTC), the California Department of Transportation (Caltrans) District 4, and the California Highway Patrol (CHP) have undertaken a Freeway Concept of Operations Study for the San Francisco Bay Area. The purpose of the study is to identify strategies to effectively manage recurring traffic congestion, incident response, and traveler information on freeways in the Bay Area.

This first phase of the Concept of Operations project resulted in a Freeway Operations Strategic Plan that recommends the future direction for Freeway Operations in the Bay Area, and an Action Plan to guide and coordinate multi-agency efforts to improve Freeway Operations.

The individual actions are grouped into three near-term, high-priority initiatives (Incident Response, Center-to-Center Communications, Efficient Operations) and two longer-term initiatives (System Sustainability and System Integration). The clustering of actions into near-term and long-term initiatives recognizes that there is insufficient staff time and funding to undertake all the actions at one time; however, each of the actions will improve Freeway Operations, and should be undertaken as soon as resources are available.

Near-Term Initiatives

The three near-term initiatives combine actions that are either already underway, or should begin by the end of 2002, to improve critical aspects of Freeway Operations. The schedules for implementing these initiatives are contingent on the availability of staff time at the regional and local agencies to develop technical and institutional solutions, and funding to implement the solutions.

1. **Incident Response and Clearance** is the highest priority for Freeway Operations in the Bay Area. The near-term initiative to improve incident detection, response and clearance includes the following specific actions:

- **Incident Management Task Force**: The near-term actions to improve incident response and clearance reside in different agencies, with some actions focusing on the incident scene and others on the Regional Transportation Management Center (TMC). An Interagency Incident Management Task (IM) Force will be formed by the Freeway Management Executive Committee and given the responsibility to implement the following five actions to improve incident management:
- **Incident Management Training**: CHP is developing an Incident Management Training Program comprised of several courses oriented to different personnel. The first course will provide supervisory staff in local agencies with an overview of incident command procedures, and will be available by the end of 2002.
- **CCTV Integration**: Over the past 20 years, Caltrans has deployed several types of closed-circuit television (CCTV) cameras along Bay Area freeways and camera control systems in the TMC. The first step, entailing \$1 million available in MTC SAFE funds, will integrate the camera control systems and upgrade camera technology and the communication system in specific corridors, so that TMC staff can quickly connect with and control cameras to confirm reports of incidents and determine the type of emergency equipment that is needed.
- **Shared Communications System**: CHP intends to deploy a communications system that will allow all agencies responding to an incident to communicate with each other, using \$2 million available

from MTC SAFE. The first steps will be to develop the system's functional requirements and design, and to develop the institutional arrangements necessary to implement a pilot project.

- CAD/FSP 'Handshake' Interface: CHP and the four largest Freeway Service Patrol agencies are working together to define and implement a two-way CAD interface for use throughout California. The next step, preparing a Feasibility Study Report (FSR), should begin in 2002/03, using FSP agency funds.
 - TOS Inventory Management System: This action entails completing an interactive database with a comprehensive inventory of a portion of the existing TOS using \$500,000 available from MTC SAFE, and tracking needed and actual investment for both repairs and routine maintenance for that portion of the TOS so that resource requirements can be tracked and forecasted over time.
2. **Center-to-Center Communications** is needed to exchange both real time data on traffic conditions as well as video images. Improved communications is expected to be a foundation for improved coordination among the three regional agencies, and between the regional and local agencies. The near-term actions in the initiative are:
- CAD/TravInfo[®] Interface: An automated system to filter CAD data, identify those incidents that effect freeway traffic flows, and extract essential data (location, type of incident, severity, etc.) is currently being developed by CHP and TravInfo[®].
 - Data Exchange System: TravInfo[®]'s capabilities will be expanded in 2003 to add a hub for real time exchange of video images and traffic data (volumes, speed, incident log and status reports, etc) between Caltrans, CHP and the Smart Corridors. The first step will be to amend the TravInfo[®] contract to define the functional requirements and design the hub.
 - Communications Backbone, Phase 1A: The first phase of the Communications Master Plan will connect the Regional Transportation Management Center (TMC) at Caltrans with Smart Corridors in Silicon Valley, the East Bay, Tri-Valley, and San Francisco through an agency-owned fiber optic backbone, and provide the hardware, software and systems integration support needed to enable real-time center-to-center communications. The initial steps will be to develop an agreement regarding the design, construction, ownership, operation, and maintenance of the Phase 1A system, and development of the system's functional requirements and design.
 - Data Exchange Policy: The agencies utilizing the data exchange system will need a Memorandum of Understanding (MOU) that defines the policies, procedures and restrictions for agency-to-agency, agency-to-media, and agency-to-public data sharing.
3. **Efficient Operation** of the existing Freeway Operations systems is a prerequisite to expansion of the capabilities and coverage of those systems. This initiative includes:
- TMC Staff Training: Personnel from Caltrans, CHP and MTC work together in the Regional TMC to address recurring congestion incident response and management, and traveler information. A unified training program and manual will help the staff from the various agencies work together, and stay current with each others changing equipment and capabilities.
 - TOS/TMC Upgrade: Upgrading and enhancing the existing TOS is vital to the success of Freeway Operations in the Bay Area. This action entails bringing the existing TOS and TMC into full and stable operations. The initial steps will be to complete the 2002 Update to the TOS Implementation Plan, and secure support from regional and local agencies for that plan and its specific projects and priorities.

- Evacuation Planning: The three regional agencies are currently developing an initial evacuation plan for one corridor to examine how the transportation system would be utilized in the event of a major disaster. The initial evacuation plan will be used to estimate the time and resources needed for a major evacuation, and to identify the key policy issues and inter-agency procedures that will need to be addressed.
- Maintenance Management System: A maintenance management program able to forecast future maintenance needs of the existing Freeway Operations systems will enable Bay Area agencies to better operate and maintain Freeway Operations systems. This system will build on the TOS Inventory Management System developed in the previous action.
- TravInfo®: The current TravInfo® enhancement will serve as a data collector, consolidator, and disseminator of freeway conditions to enable travelers to make informed decisions about their travel and enable regional and local agencies to better manage Freeway Operations.
- Regional Intelligent Transportation System (ITS) Architecture: The Regional ITS Architecture currently being developed will ensure compatibility between systems and the sharing of data between agencies. This planning effort should be completed in 2003/04, and will provide the framework from which regional and local agencies can build their ITS systems.

Longer-Term Initiatives

In addition to the three near-term initiatives, two longer-term initiatives should be undertaken as soon as the agencies can provide the staff time necessary to address the technical and institutional issues.

4. System Sustainability

- Ongoing Capacity Building: Coordinated training for Freeway Operations personnel in regional and local agencies will be expanded from the incident management and TMC staff training to center-to-center coordination, evacuation planning and management, and other topics.
- Completion of TOS: The Bay Area needs a regional consensus regarding the level of resources that should be invested in freeway operations, and the geographic area that should be covered by the TOS.
- Communications Backbone, Phases 2-4: The communications backbone presented in the Communications Master Plan will enable Caltrans and other agencies to communicate with a portion of the TOS field equipment over an agency-owned system. This will decrease annual operating costs.
- Maintenance Funding Requirements: The initial TOS maintenance management program developed as a near-term action will be expanded to other Freeway Operations agencies. This system will allow the agencies to define maintenance requirements for the various Freeway Operations systems, and both advocate for needed funds and balance the size of the systems with the ability to maintain them.
- Staffing and Funding Requirements: The regional and local agencies involved in Freeway Operations need a staffing and funding program that will track the staffing and funding levels for current systems, and improve the ability to forecast future needs.

5. System Integration

- Interoperable Communications System: Emergency response agencies will need to migrate to a common radio frequency or communication system to allow direct communications between vehicles and personnel in the field.

- Enhanced CAD: This action will support the initiation of the long-term effort to upgrade and enhance the statewide CAD by surveying efforts throughout the country to develop enhanced CAD's and defining the Bay Area's needs and priorities.
- System Integration Plan: The Strategic Integration Plan will define the Bay Area's needs and priorities for migrating from the existing system of independent systems to a regionally integrated system.
- Regional Data and Video Sharing Policy: The MOU for data and video sharing that was developed as a near-term action will be used to develop a regional policy and guidelines.
- Integrate Incident Detection: TravInfo® staff currently collect and manually consolidate reports of freeway incidents that affect freeway congestion. This action will develop a more automated and integrated system to collect incident detection data from several agencies and sources, integrate the data to combine multiple reports of a single incident, and concisely report accurate data to all involved agencies.
- Ramp Metering Outreach: This action will develop a dialog between Caltrans and local agencies to discuss the potential benefits of ramp metering and operational strategies that could accommodate corridor-specific issues and improve freeway and arterial operations.

1. INTRODUCTION

MTC, Caltrans District 4, and CHP have undertaken a Freeway Concept of Operations Study for the San Francisco Bay Area. The purpose of the study is to identify strategies to effectively manage recurring traffic congestion, incident response, and traveler information on freeways in the Bay Area.

The goal of the Bay Area Freeway Concept of Operations is to improve Freeway Operations policies, procedures, and practices, and build consensus on the roles, responsibilities, and resource needs for Freeway Operations. Freeway Operations are the activities that directly affect the safety, travel time, travel route selection, time of travel, or mode of travel, of travelers using or planning to use the freeway network. This first phase of the Concept of Operations project resulted in a Freeway Operations Strategic Plan that recommends the future direction for Freeway Operations in the Bay Area, and an Action Plan to guide future work on the Freeway Concept of Operations.

The first phase of the Freeway Concept of Operations Project began with the development of a vision statement, goals and objectives for the project. The two goals are:

- Operate the Bay Area Freeway System in a manner that is safe, efficient, and reliable.
- Better manage and coordinate the procedures and resources of agencies involved in Freeway Operations.

The project included a significant effort to inventory the written policies, standard operating procedures, and informal practices of the three regional agencies (Caltrans, CHP and MTC) and five local agencies (Alameda County and the cities of Concord, San Jose, Santa Rosa, and San Mateo). The inventory informed the definition of key institutional and technical issues, which was used to develop the Strategic Plan. The Freeway Operations strategies address the key institutional and technical issues, including modifications to the roles, responsibilities and resources for Freeway Operations.

This document addresses the previously identified strategies and provides a recommended sequence of actions to implement each of the strategies. The Action Plan for each strategy begins with the definition of the strategy and a summary of the issues to be addressed. Each Action Plan then defines the steps needed to implement each strategy, recommends which agency should be responsible for leading the implementation, and defines the timeframe and resources needed to implement each strategy.

This cost information is very preliminary and is based on the assumptions presented. The costs are provided for budgeting purposes.

2. ACTION PLANS

This section presents an action plan for each strategy identified in the Strategic Plan. Implementation of most of the strategies entails both near-term and longer-term actions. For example, the first strategy in the Strategic Plan, “Develop Regional Strategic Plan for System Implementation and Integration”, entails the near-term action to implement a “Data Exchange System” as well as the longer-term action to develop a “system Integration Plan”. In order to make the relationship of the actions and strategies transparent, the Action Plans use the same names as the Strategic Plan. The one exception is the first action, “Regional Incident Management Task Force”, which was defined after the Strategic Plan was adopted. The Action Plans are numbered based on the first time the strategy appears in three near-term initiatives and two longer-term initiatives as presented here:

Near-Term Initiatives:

- Incident Response and Clearance;
- Center-to-Center Communications; and
- Efficient Operations.

Longer Term Initiatives:

- System Sustainability; and
- System Integration.

2.1 Strategy: Regional Incident Management Task Force

Objective: To improve incident detection, response and clearance for the incidents on the freeway system in the Bay Area.

Action Plan: The need for improved incident management has been articulated in many separate studies and programs over the last two years, and the “MTC SAFE Call Box Program 5-Year Strategic Plan” adopted in June 2002 includes funds to address several of the needed actions. Portions of these actions currently reside with different agencies, with some actions focusing on the incident scene and others on the Traffic Management Center. There is a real need for these activities to be integrated into a shared partnership process at the regional level, where roles and responsibilities can be assigned to the strengths of each agency. The three-member Freeway Management Executive committee should appoint representatives from each regional agency, and charge them with the responsibility to implement specific actions as described in the Incident Response and Clearance Initiative.

Lead Agency: CHP, Caltrans, and MTC should form the Incident Management Task Force as a true partnership. MTC may serve as the facilitator to coordinate the activities.

Schedule of Activities: The establishment of the Regional Incident Management Task Force should begin as soon as possible. This is an on-going activity and should be made a part of the overall program of the regional agencies.

Resources: Staff from MTC, CHP, and Caltrans will need to allocate time for this effort. MTC, as the facilitator, should budget one full time equivalent (FTE) working 60 hours per month, and CHP and Caltrans should budget one FTE working 40 hours per month for this effort.

2.2 Strategy: Establish On-going Interagency Capacity Building

Objective: To improve Freeway Operations by coordinating training and professional capacity building among regional and local agencies involved in Freeway Operations in the Bay Area.

Action Plan: A substantial benefit will be realized by having coordinated training programs involving staff from the regional and local agencies that are most heavily involved in Freeway Operations. Not only are economies of scale benefits derived, but with consistent advanced training, the people responsible for traffic management activities can provide consistent high levels of service throughout the system. These benefits accrue directly to the traveling public. It will clearly be a positive step if the region ensures that staff from different agencies obtain the same levels and types of training. Steps to realizing the benefits from this type of coordination include:

1. **Near-Term Action: Implement Incident Management Program (Incident Response and Clearance Initiative):** CHP intends to begin providing incident management training for command personnel by the end of 2002. Additional training courses will be developed for other incident management personnel. Training will be provided on an annual basis in each of the Bay Area's 11 Area Commands for all agencies involved in incident response.
2. **Near-Term Action: TMC Staff Training (Efficient Operation Initiative):** Develop a program to train staff from the three regional agencies that work together in the Regional TMC. This training should promote everybody's understanding of each agency's standard operating procedures and informal practices, and identify opportunities to improve interagency communication and coordination.
3. **Ongoing Capacity Building (System Sustainability Initiative):** Define a training and capacity building program that focuses on other areas that are priorities for Bay Area Freeway Operations, such as center-to-center coordination and evacuation plan management. This effort should develop information such as the specific topics to be taught, the duration and sequencing of training modules, and resources needed to conduct the training. The costs of a regional training program should also be identified. The conclusion of this step is a document that will define the content and schedule for the training program for the next two years.

Lead Agency: CHP is responsible for the incident management training program, and MTC should lead the effort to develop inter-agency training for the Regional TMC staff, and for preparation of the multi-year Freeway Operations Training Program. Specialists from partner agencies may be called upon to teach certain topics and provide specialized training.

Schedule of Activities: Preparation of each course will require approximately three to six months. The first course in the Incident Management Program will be available in late 2002. MTC should provide the Regional TMC Operations course in the first half of 2003, and define the overall Freeway Operations Training Program by the end of 2003.

Resources: CHP and MTC will need to allocate staff time for this effort. CHP and MTC will need to allocate approximately one FTE each working 40 hours per month for the duration of the training. It may be advisable for MTC to budget \$50,000 for consultant support for developing both the Regional TMC Operations training and the overall training program.

2.3 Strategy: Caltrans TOS/TMC Enhancement and Completion

Objective: To upgrade and enhance Caltrans' existing TOS and TMC, and develop a regional consensus on completion of the TOS. This will require a comprehensive program that considers future resources needed to build, operate and maintain the TOS and TMC; to interface and integrate various systems; and to accommodate the evolution of technology.

Action Plan: Upgrading and enhancing the existing TOS is vital to the success of the overall Freeway Operations systems in the Bay Area. The first step is to bring the existing TOS and TMC into full and stable operation, and then to document the annualized costs and benefits of TOS/TMC. Based on its costs and benefits, and the ability to secure resources to sustain the TOS over time, the Bay Area

Partnership should determine whether the TOS should be completed for the remaining freeway mileage. Action items related to this endeavor include:

1. **Near-Term Action: CCTV Integration (Incident Response and Clearance Initiative):** Over the past 20 years, Caltrans has deployed different CCTV cameras along Bay Area freeways and different camera control systems in the TMC. This first step, entailing \$1 million in SAFE funds, will integrate the camera control systems and upgrade camera technology and the communication system in specific corridors so that staff in the TMC can quickly connect with and control cameras to confirm reports of incidents and determine the type of emergency equipment that is needed.
2. **TOS/TMC Upgrade (Efficient Operations Initiative):** This action entails bringing the TOS/TMC into full and stable operations. The initial steps will be to complete the 2002 Update of the TOS Implementation Plan, and secure support from regional and local agencies for that plan and its specific projects and priorities.
 - A plan for enhancing the TMC software should be included as part of the TOS Implementation Plan.
 - Additionally, the TOS Implementation Plan should include a plan for integrating with other data sources such as TravInfo[®] probe data, CHP CAD, and Smart Corridor data, and an integrated approach to data archiving and retrieval.
3. **Completion of TOS (Efficient Operation Initiative):** The Bay Area needs a regional consensus regarding the level of resources that should be invested in freeway operations, and the geographic area that should be covered by the TOS. Initial steps would be to incrementally enhance or replace the TMC software so that the TMC can add functionality and become interconnected with more systems. These enhancements to the TMC software will need to 1) meet the needs of the Bay Area and 2) be consistent with the Caltrans Headquarters TMC Master Plan for the TMC software and the 2002 TMS Master Plan.
 - Many of the existing TOS field elements will need to be upgraded with newer technology to improve system functionality and reliability, and to reduce the number of legacy systems.
 - As new standards become approved and adopted, migrate legacy systems to comply with these new standards.
 - An equipment monitoring system is needed to detect when TOS/TMC components have failed, are not operating correctly, or are in need of maintenance. This automated equipment monitoring system should alert Caltrans of specific malfunctions and maintenance needs. This system also should have a database and be capable of tracking maintenance activity on a per-device or per-system basis, and be able to help “predict” future maintenance needs and requirements.
 - Once the improvements and planned near-term TOS activities (as outlined in Caltrans’ 2002 TOS Implementation Plan) are complete, it will be important to develop a regional consensus about completing the TOS to include additional freeway miles in the Bay Area. Caltrans will need to gain the support of local agencies in order to secure the funding and cooperation necessary to complete the TOS.

Lead Agency: Caltrans should be the lead agency in this effort. Active participation and support from the regional and local agencies will be essential in order to secure the funding and cooperation necessary for implementation.

Schedule of Activities: The near-term action of integrating the CCTV control systems should get underway in 2002/03, and be completed in 2003. An additional twenty-four months might be required to enhance the TMC Software. Upgrading and replacing the existing TOS infrastructure as well as

implementing the TOS/TMC equipment monitoring system could require two to four years, depending on funding availability. And finally, if funding is available, another five to seven years will be needed to complete the TOS to include remaining freeway miles in Bay Area.

Resources: Caltrans will need to allocate significant time from supervisory and technical staff for this effort, as well as funds for consultant assistance. Construction costs for freeway management systems typically run about a \$1 million per mile of freeway, and annual operation and maintenance costs typically are 10% to 15% of construction costs. This figure is heavily dependent on the communication architecture and whether extensive communication infrastructure is required. Design is typically 10% of this amount, and construction administration is between 5-10%. This is very much a “rule of thumb” tool, but it is reasonable for budget allocation purposes.

2.4 Strategy: Provide Common Radio Frequency for Emergency Responders

Objective: To implement a shared communications system for emergency responders in the near-term, while defining the requirements for migrating all agencies to a common frequency over the longer term. Currently, the various emergency response agencies operate their radios on their own frequencies. With different frequencies, it is cumbersome to communicate with each other through their dispatch centers.

Action Plan: There is an urgent need for a system that allows fire and police departments, EMS units, CHP, and Caltrans units that are responding to an incident to directly communicate with each other. The long-term solution entails a radio frequency which would be utilized by public and private emergency responders and provide for enhanced communications among dispatch centers as well as improve communications between dispatch and personnel/vehicles in the field during critical situations. The following steps are anticipated:

1. **Near-Term Action: Shared Communications System (Incident Response and Clearance Initiative):** CHP is reviewing a radio interface system that is able to transfer communications across several systems (radio, cellular phone, landline telephones, etc.). This computerized system can share communications across all system that are connected to it, allowing all participants to hear each other, and has been implemented elsewhere in California. Initial steps should include:
 - Develop the system’s functional requirements and design, and develop the institutional arrangements necessary to implement a pilot project.
 - Perform a scan of available technologies to share communication across agencies at either a specific incident site or across entire communication systems;
 - Perform an evaluation of trade-offs in terms of signal strength and coverage, inclusion of numerous agencies while being able to discern messages from specific individuals and agencies, and the cost and maturity of various systems; and
 - In cooperation with MTC SAFE, procure an interim system in 2002/03.
2. **Long-Term Action: Interoperable Communications System (System Integration Initiative):** Emergency response agencies will need to migrate to a common radio frequency or communications system to allow direct communications between vehicles and personnel in the field. Determine the intention of Bay Area agencies to develop a common radio frequency or other shared communications system. For example, in addition to the police, fire, and emergency services agencies, it may be useful for Caltrans Maintenance, the Caltrans Traffic Management Team, FSP, and the County Coroner to have access to this system. This will require a substantial effort, and in the end, needs to obtain the following information for each participating agency.
 - Who will participate in this coordination?

- Is a completely new central system the best approach, or should all users have the ability to use a common frequency with the existing radio equipment? Investigate the feasibility of using a radio interface system (as is being tried in Southern California) to utilize existing radio systems.
- What amount of money is currently spent on the individual radio systems?
- What is their current usage amount, bandwidth, and number of channels. Do they foresee any necessary expansion in the near future? This information will help determine how big the new system will need to be.
- What security features does their system currently possess and what might it need in the future?
- What area will the frequency need to cover? This will determine characteristics of the frequency such as power and number of repeaters.
- What other features might this frequency need to be supportive of their organization?
- Determine a frequency that will service all desired areas. There are some radio frequencies that are available for mutual aid by Bay Area agencies such as CLERS, CLEMARS, and CALCORD. Perhaps one of these frequencies can be used and operating procedures be developed for its use.
- Guidelines will need to be established regarding user priority and a “hierarchy” of use. This is to say, what organizations or instances have priority and what is the order of hierarchy.
- Seek new funding opportunities under new Security Funding Programs established by the federal government. As a high-profile region of the country, the Bay Area could be eligible for federal funding to support this kind of planning activity.
- Start by implementing in one small area. This will allow for troubleshooting.
- Once confidence in system is achieved, convert all involved parties over to common radio system.
- Conduct an analysis of the installation, integration, and ease of use of the new system. To be conducted by each agency in an attempt to develop a “what did we learn, and what can we improve” scenario.
- Develop a training manual that states rules and guidelines for frequency use, and distribute it to those involved.

Lead Agency: CHP should be the lead agency in this effort. Support from representative local agencies, primarily law enforcement and emergency services, will also be sought for participation in the task force. Close coordination with Caltrans and MTC is needed.

Schedule of Activities: The system to share radio communications using existing systems can be completed in 2002 and 2003. Approximately three years should be allotted for the conversion to a common radio frequency or other system. This time frame is contingent on the schedule for findings and recommendations from associated Action Items.

Resources: Staff from the CHP and from participating agencies including Caltrans and MTC will need to allocate time for this effort. CHP, as the lead agency, should budget for a full time project manager for one year and 80 hours a month for the additional two years of activity. Similarly, time will be the primary resource asked of local agencies as well, including primarily law enforcement and emergency services, but will be below the effort of the lead agency personnel.

MTC SAFE has proposed budgeting up to \$2 million to purchase and implement the interim system. A consultant budget of \$300,000 is recommended for the planning and preliminary design steps for the

permanent system. It is not practical to estimate the costs of the final radio system until the final design is completed.

2.5 Strategy: Develop and Implement an Enhanced and Integrated CHP CAD System

Objective: To develop and deploy an upgraded CAD system that meets the needs of CHP and other Bay Area agencies. The CHP Computer Aided Dispatch (CAD) system is required to perform many tasks that it wasn't originally designed to do. The objective of this strategy is to implement a new CHP CAD system with automated interfaces with other Freeway Operations systems including the call box answering center, FSP computer, TravInfo® and the TMC. The new CHP CAD system should provide useful log data on location of incidents, which could be used by MTC for planning call box redeployment or better utilization of existing call boxes as incident notification devices.

Action Plan: This action plan will develop and deploy an upgraded CAD system. Implementing an enhanced CHP CAD system will be a long-term, statewide undertaking. In the interim, automated interfaces to the existing CAD need to be developed. The specific attributes of an enhanced CAD will be determined in the initial steps of the action plan. Thus, the following steps are recommended:

1. **Near-Term Action: CAD/FSP 'Handshake' Interfaces (Incident Response and Clearance Initiative):** CHP and the four largest Freeway Service Patrol agencies are working together to define and implement a two-way CAD interface for use throughout California. The next step, preparing a Feasibility Study Report (FSR), should begin in 2002/03, using FSP agency funds.
2. **Near-Term Action: CAD/TravInfo® Interface (Center-to-Center Initiative):** An automated system to filter CAD data, identify those incidents that effect freeway traffic flows, and extract essential data (location, type of incident, severity, etc.) is currently being developed by CHP and TravInfo®.
3. **Enhanced CAD (System Integration Initiative):** This action will support the initiation of the long-term effort to upgrade and enhance the statewide CAD by surveying efforts throughout the country to develop enhanced CAD's and defining the Bay Area's needs and priorities. Survey the efforts throughout the country to develop and enhance CADs, including efforts initiated after the 9/11 attacks. Define the Bay Area's goals, objectives, and perceived constraints in developing a new CAD. This is essentially preparation of a scope of services to be used by CHP in retaining outside services for the effort to update and refine the CAD system.

Lead Agency: CHP is the lead agency in this effort because this is their system to own and operate. Extensive coordination with system personnel from MTC, Caltrans and other system operators will be required to gain the appropriate integration and user interfaces.

Schedule of Activities: Step 1 should be completed in 2002/03. Steps 2 and 3 should be completed by mid-2004.

Resources: Staff from the CHP will be primarily responsible for leading this effort. CHP, as the lead agency, should budget one FTE working 80 hours a month for two years for this project. Staff from participating agencies also will need to allocate time for this effort.

The development of the TravInfo® and FSP interfaces are already funded and underway. An amount of \$100,000 in consultant assistance is recommended for funding both the national survey and goal setting steps.

2.6 Strategy: Develop System Integration Plan for Freeway Operations

Objective: To develop an overall strategic plan to migrate from the existing independent systems to a regionally integrated system for Freeway Operations. The Concept of Operations Strategic Plan focuses on key strategies aimed at improving interagency communication, infrastructure, and long-term planning for Freeway Operations. It also developed the portion of the ITS Regional Architecture for Freeway Operations, including defining interagency data flows and applicable standards. The System Integration Plan will outline specific integration requirements, priorities, and phases, and define the timing, funding, operation and maintenance responsibilities, and other requirements to implement an integrated Freeway Operations system.

Action Plan: This effort will result in a user-friendly document that will offer guidance on the design, construction/deployment, and operation of the regional freeway operations infrastructure and systems. This document will address key issues including system functionality, TMC requirements and upgrades, center-to-center communications and integration, as well as funding and scheduling for implementation, operations, and maintenance. The System Integration Plan for Freeway Operations will need to build on several ongoing efforts that are scheduled to be completed in the next year or two; therefore, it is recommended that the system integration plan be divided into two phases, as follows:

1. **Near-Term Action: Data Exchange System (Center-to-Center Communications Initiative):**
The regional and local agencies involved in Freeway Operations need a stable system to exchange real time data and video images for system management and traveler information. Uncertainties over the schedule for opening the Regional TMC, and developing the next generation of the TMC software, make it difficult to implement stable, automated interfaces with the Caltrans' TMC. As an interim step until these uncertainties are resolved, TravInfo®'s capabilities will be expanded in 2003 to provide a hub for real time exchange of video images and traffic data (traffic volume data, lists of significant incidents, etc.) between Caltrans, CHP and the Smart Corridors for system management and traveler information. The initial steps include:
 - Create a Freeway Operations Center-to-Center Working Group to support development of the system. The Center-to-Center Working Group would include representatives from Caltrans, MTC, Bay Area Smart Corridors, and other interested agencies and would report to the Freeway Management Executive Committee.
 - Develop an MOU that defines the data to be exchanged and the protocols and procedures that will be used. Significant progress on this step occurred at a meeting between affected agencies in February 2002.
 - Amend the TravInfo® contract to add definition of the data exchange systems functional requirements and design of the hub.
 - Develop a hub for real-time center-to-center data exchange. This system is included in the \$3.1 million budget Phase 1 of the Communications Master Plan, but funds for Phase 1 have not been programmed. The Data Exchange System, and connection of the Regional TMC and existing Smart Corridors to the communications backbone, would cost approximately \$1 million.
2. **Systems Integration Plan (System Integration Initiative):** The regional Strategic Integration Plan will define the Bay Area's needs and priorities for migrating from the existing system of independent systems to a regionally integrated system. The Bay Area needs to build on and consolidate several existing efforts, including development of the Regional ITS Architecture and the TOS Implementation Plan, implementation of currently programmed Smart Corridor projects (Silicon Valley-ITS Enhancement Project, East Bay Smart Corridors, Tri-Valley Smart Corridor, and SFgo), and implementation of the center-to-center data exchange system described above.

- Develop a working group of regional agencies and smart corridor lead agencies to support the effort. This will likely be a continuation or expansion of the Freeway Operations Center-to-Center Working Group.
- Provide a blueprint for how traffic and incident data will be collected, integrated and distributed by the three regional agencies. Address how to integrate probe data (TravInfo®, Freeway Service Patrol), detector data from TOS, and incident data from CHP CAD and disseminate this information to regional and local agencies, as well as to the public.
- Prepare draft and final Regional Strategic Plan for System Integration. Document should define priorities and specific actions for the integration of regional and local systems into the regional freeway operations system.

Lead Agency: MTC should be the lead agency for both the near-term center-to-center data exchange system and the longer-term effort to complete the System Integration Plan. Close coordination with Caltrans and CHP is also expected at both the technical and executive levels. Active participation by representatives from the Smart Corridors is essential to the success of this undertaking.

Schedule of Activities: Development and implementation of the center-to-center data exchange system should begin as soon as possible, and will take approximately 18 months if funding is available when needed. The sequence of steps will be creation of the Freeway Operations Center-to-Center Working Group, development of the MOU, specification of the modifications to TravInfo®, and then implementation of the modifications. Concurrent efforts will be needed to implement a portion of Phase 1 of the Communications Master Plan and develop a second MOU on the policies and procedures for data sharing. Development of the overall System Integration Plan for Freeway Operations could start soon after the center-to-center data exchange system begins operations, and will take an additional 6-12 months. This starting date for the System Integration Plan is contingent on completion of the 2002 Update of the TOS Implementation Plan and Regional ITS Architecture.

Resources: MTC and the participating Smart Corridor agencies will need to allocate substantial staff time for this effort during the next three years. MTC, as the lead agency, should budget one FTE working half time for one year plus one FTE working 20 hours a month for two additional years. In addition, funds will be needed to design and implement the TravInfo® modification. Those funds have been included in Phase 1 of the Communication Master Plan, but funds to implement Phase 1 have not been programmed. There will also be a minor increase in TravInfo®'s annual operating and maintenance costs. Development of the System Integration Plan is expected to entail \$300,000 in consultant assistance, and implementation of that plan will require an unknown amount of funding.

2.7 Strategy: Establish Maintenance Program for Freeway Operations

Objective: To develop a maintenance program to keep equipment and software operational, and to forecast future resource needs to repair and maintain the existing systems. Several different agencies have made substantial investments during the past 20 years to implement the Bay Area's existing Freeway Operations systems.

Action Plan: This effort will result in a maintenance program for Freeway Operations systems that will create and maintain a comprehensive inventory of the various Freeway Operations systems and their individual components, track both needed and actual investment for both repairs and routine maintenance, and forecast future resource requirements to keep the Freeway Operations systems functioning at an optimal level. It will provide a comprehensive set of maintenance guidelines, needs, requirements, processes and element-specific maintenance information. The maintenance program will include equipment monitoring mechanisms that can also be used as a "predictive" maintenance tool,

thereby streamlining the maintenance need identification process based on the performance history of certain components of the field, communications, and operations center equipment. The maintenance program will also be used to monitor existing year resource requirements as well as forecast future year resource requirements, and identify any deficiencies. This will ensure a balance is maintained between the size of the Freeway Operations system and the ability to operate and maintain it. Action items anticipated to bring about this effort include:

1. **Near-Term Action: TOS Inventory Management System (Incident Response and Clearance Initiative):** This action entails completing an interactive database with a comprehensive inventory of a portion of the existing TOS using \$500,000 available from MTC SAFE, and tracking needed and actual investment for both repairs and routine maintenance for that portion of the TOS so that resource requirements can be tracked and forecasted over time. The comprehensive inventory and database will include type and number of devices, performance history, and warranty information. This is envisioned to be a relational database tool or similar approach. The database would contain information describing maintenance requirements, parties responsible for the maintenance activities, and the dates on which maintenance activities were conducted. It may be desirable to develop this database inventory management system in stages, starting with one or two counties. This will ensure that the software system, database design, and the quality of available data are all properly specified prior implementing the full database system.
2. **Maintenance Funding (System Sustainability Initiative):** The initial TOS maintenance management program developed as a near-term action will be expanded to other Freeway Operations agencies. This system will allow the agencies to define maintenance requirements for the various Freeway Operations systems, and both advocate for needed funds and balance the size of the systems with the ability to maintain them.
 - Document existing maintenance capabilities and resources, and then compare/contrast the two sets of information to accurately portray the current conditions and shortfall.
 - Outline requirements and options for an overall maintenance program. Assess whether contracted operations would be appropriate for specific devices or systems as part of the program development. Assess whether shared maintenance agreements between agencies would be, cost-effective, and/or feasible given liability constraints. Identify preferred approach to maintenance. Develop a configuration management plan.
 - Define program activities based on the preferred approach. Budgets, interagency agreements, and related administrative details will be identified and developed. A summary report on maintenance programming will be developed as the conclusion to the planning effort.

Lead Agency: Caltrans is the lead agency on this effort, and would be the primary user and beneficiary of such a system. Should local agencies express interest in participating in a distributed maintenance management tool, they would be expected to become involved after the prototype system in Step 1 is implemented.

Schedule of Activities: Work on Step 1 – completing the prototype inventory and database – should begin immediately, using the \$500,000 available from MTC SAFE. The analysis and prototype development portion of this action plan is likely to require up to one year to complete. Deployment of the maintenance system to the full TOS/TMC, and inclusion of other agencies, could take from one to three additional years depending upon the specific nature of the program, the number of agencies involved, and the availability of funding.

Resources: Caltrans will need to allocate approximately two FTE professionals working 80 hours per month each for twelve months for this effort. This action may entail consultant assistance, and \$500,000

is available from MTC SAFE for completing the inventory of a portion of the existing TOS equipment and development of the inventory management system.

Completion of a regional inventory management system could require anywhere from several hundred thousand dollars to several million dollars depending on the complexity and functionality of the system.

2.8 Strategy: Establish and Maintain a Sustainable Communications System for Freeway Operations

Objective: To establish and maintain a sustainable communications system that provides the reliability, bandwidth, and functionality necessary for the Bay Area's Freeway Operations system at an affordable cost. The TOS, for the most part, uses leased communication systems between the Regional TMC and field equipment throughout the Bay Area, which creates the potential for limited functionality or service interruptions during a budget crisis. TravInfo® and the Smart Corridors are deploying communication systems, many of them on or adjacent to freeway segments, and Caltrans has the use of four fibers in the BART fiber optic communications system. The Freeway Operations Communications Master Plan provides for an agency owned communications backbone to support center-to-center and center to hub communications at a decreased annual cost.

Action Plan: Planning for a communications network for Freeway Operations is already underway, which includes the recently completed Communications Master Plan. The recommended communications network will provide a backbone communications system that can serve as a foundation for improved communication, coordination and information exchange (data and video) among Bay Area agencies involved in Freeway Operations. The backbone system can be built-out in phases, and can accommodate future expansion and communications needs. Action items include:

1. **Near-Term Action: Communications Backbone, Phase 1A: (Center-to-Center Initiative):** The first phase of the Communications Master Plan will connect the Regional Transportation Management Center (TMC) at Caltrans with Smart Corridors in Silicon Valley, the East Bay, Tri-Valley, and San Francisco through an agency-owned fiber optic backbone, and provide the hardware, software and systems integration support needed to enable real-time center-to-center communications. The initial steps will be to establish a center-to-center working group, develop an agreement regarding the design, construction, ownership, operation, and maintenance of the Phase 1A system, and development of the system's functional requirements and design.
 - The Center-to-Center Working Group includes representatives from Caltrans, MTC, Bay Area Smart Corridors, and other interested agencies to guide the implementation of Phase 1A of the Communications Master Plan.
 - Development of an MOU regarding the design, construction, ownership, operation and maintenance of the communications backbone system. The MOU should be reviewed by appropriate staff at Caltrans Headquarters.
 - The design and implementation of the center-to-center portion of Phase 1 of the Communications Master Plan. This first portion will provide for center-to-center communications between the Regional TMC and the Smart Corridor TMCs, but should be constrained to a cost of under \$1 million to avoid the need to prepare a Feasibility Study Report. Funding for the design and implementation of this portion of Phase 1 will need to be programmed.
2. **Communications Backbone, Phases 2-4 (System Sustainability Initiative):** The communications backbone presented in the Communications Master Plan will enable Caltrans and other agencies to communicate with a portion of the TOS field equipment over an agency-owned system. This will decrease annual operating costs.

- A funding strategy is needed for phases 2-4 of the Communications Master Plan. Funding could be secured through a Congressional earmark, which in turn would expedite review and approval of the project by state and local agencies.
- Prepare designs and Plans, Specifications, and Estimates for the individual projects that will comprise the communications backbone system.

Lead Agency: MTC should be the lead agency for Phase 1, and Caltrans should be the lead agency for the remaining phases. Close coordination with the Smart Corridors will be essential.

Schedule of Activities: The Center-to-Center Working Group should be established and start work on the MOU during 2002. Approximately twelve months should be allotted to design and implement the first portion of the communications backbone. If funding is available in FY 2002/03, the system should be operating by the end of 2003. More time will be needed to design and implement the total system, and this time period is also contingent on the availability of funding.

Resources: Staff from the MTC and from participating agencies will need to allocate time for this effort during 2002/03. MTC, as the lead agency for Step 1, should budget one FTE working 80 hours per month for 12 months for project management. Caltrans, as the lead agency for subsequent steps, should budget 80 hours per month for the duration of the program. Development of the MOU, the center-to-center systems concept design, and the PS&E package for the center-to-center system is expected to entail consultant assistance and is estimated to cost \$575,000. An annual budget of \$25,000 is recommended for the communication network oversight work. Implementation of the total Communications Master Plan is expected to entail \$22.9 million.

2.9 Strategy: Develop Overall Data and Video Sharing Policy

Objective: To develop a policy that defines how video and other real time data are shared among Caltrans, MTC, CHP, Smart Corridor programs, local transportation agencies, and with the media and the public. This data includes real-time traffic data, live closed-circuit television images, incidents, closures, and advisories issued by the agencies.

Action Plan: Developing specific guidelines and policies for data and video exchange will facilitate timely exchange of information between Bay Area agencies. Other Action Plans create the physical framework that will enable Bay Area agencies to share data and video. Policies should be developed and implemented governing usage, including any restrictions on use, of available data and video. Action items associated with this effort include:

1. **Near-Term Action:** Data Exchange MOU (Center-to-Center Communications Initiative): The Smart Corridor agencies using the center-to-center data exchange system will need to develop a Memorandum of Understanding that defines the policies, procedures, and restrictions on agency-to-agency, agency-to-media, and agency-to-public data sharing. A Freeway Operations Center-to-Center Working Group should be formed to assist in developing and gaining approval of the Data Exchange MOU, as well as the MOU for the design, construction, ownership, operations and maintenance of the Phase 1 communications system. The Working Group will include representatives from Caltrans, MTC, the Smart Corridors, and other interested agencies.
2. **Regional Data and Video Sharing Policies (System Integration Initiative):** The MOU for data and video sharing that was developed as a near-term action will be used to develop a regional policy and guidelines.
 - Based on the experience in developing and implementing the Data Exchange MOU, develop a regional policy and guidelines that address at least the following aspects:
 - Data sharing agency-to-agency, agency-to-media, and agency-to-public;

- The data and video sharing policy will outline specific parameters and standards that are applicable for sharing data and video from center to center;
- Determine what security and accessibility measures need to be in place (such as a firewall, XML feed, and other support infrastructure) to allow access to Bay Area data by the private sector, such as the media, information service providers, and other private companies;
- Address standards applicable for ATIS data and video as part of this policy; and
- Address guidelines for terms of use for data, restrictions on use, data security, archiving, and other parameters.
- Address how costs associated with data sharing will be handled.
- Develop a policy that defines the agency roles, responsibilities, and procedures for exchanging data and video. Circulate the draft policy to other public agencies, the news media, other interested groups, and the public for review and comment.
- Develop a final policy based on the comments received, and incorporate it into the Regional Transportation Plan.

Lead Agency: MTC should be the lead agency in this effort. Close coordination with Caltrans, CHP, Smart Corridor programs, and local transportation agencies is expected in developing the recommended policies and guidelines. Support from the media and the public will also be sought in the form of participation in a technical/policy advisory body.

Schedule of Activities: Approximately twelve months should be allotted to the development of an overall data and video sharing policy. Gaining signed MOU's from local agencies will take three to six months, depending on the individual requirements of those agencies. Development of a policy statement for inclusion in the Regional Transportation Plan may require an additional year.

Resources: MTC, Caltrans, CHP, and Smart Corridor agencies will need to allocate substantial staff time for this effort during the next 18 months. Development of the Data and Video Sharing Policy may entail consultant assistance with facilitation and development of drafts..

2.10 Strategy: Develop Regional Evacuation Management Plans

Objective: To define how the Bay Area freeway system would be utilized in the event of a major evacuation situation. Numerous agencies in the Bay Area already have plans in place for earthquake response and other emergency situations. Traffic management plans are being developed in the event that one or more of the bay bridges is closed to traffic. This effort will identify the agencies that would need to be involved in a major evacuation, and identify their responsibilities.

Action Plan: An initial evacuation plan will be developed and used to estimate the time and resources needed for a major evacuation, and to identify the key policy issues and inter-agency procedures that will need to be addressed. The following steps are anticipated:

1. **Near-Term Action: Evacuation Planning (Efficient Operation Initiative):** Caltrans, CHP, and MTC have formed a small task force to develop the initial evacuation plan, starting with one corridor or sub-region. The task force is examining how the freeway system could be utilized in the event of a major evacuation. Two areas will be explored: movement of the public away from a disaster, and movement of emergency vehicles to and from the disaster area. This effort considers such options as reverse flow on freeways to allow for one-way travel, and use of shoulders as additional lanes at key bottleneck locations. The initial evacuation plan will be used to estimate the time and resources needed for a major evacuation, and to identify the key policy issues and inter-agency procedures that will need to be addressed.

- Review the initial evacuation plan with appropriate federal, state and county emergency management agencies.
- Conduct an evacuation management workshop in the effected sub-region as a forum to get agencies to focus on this issue. In the course of the workshop, discuss the resources (infrastructure, personnel, equipment, etc.) that would be required to carry out the evacuation management plan, and the potential roles and responsibilities of the agencies at the workshop, and identify key issues and constraints.
- Based on input from the workshop, modify the initial evacuation plan, and use that plan as a guide in developing evacuation plans for other corridors and sub-regions.
- Incorporate evacuation management training into CHP's incident management training program. This effort implies that a series of operational policies and procedures will be developed to guide the real-time actions of traffic management personnel during evacuations. These policies and procedures are envisioned to include chain of command, information flow, and lines of communication.

Lead Agency: CHP should be the lead agency in this effort. Caltrans and MTC are expected to actively participate in the task force (Step 1), and monitor subsequent steps. Other agencies will need to provide cooperation and staff time to support this endeavor.

Schedule of Activities: The schedule entails development of the initial evacuation management plan (complete in 2002), review by state and regional agencies, and completion of the workshop on the initial evacuation management plan early in 2003. This time frame is contingent on the schedule and level of involvement of the task force, as well as the complexity of the plan that emerges. Plans for additional corridors or sub-regions could be developed relatively quickly, using the initial plan as a guide.

Resources: As the lead agency, CHP staff will need to spend 60-80 hours developing the initial plan by August, 20-40 hours reviewing it with state and federal agencies, and 40 hours preparing for the workshop. The time needed to respond to comments from the workshop is difficult to estimate, but could be as high as 40 hours. The development of the initial plan is expected to entail 2 or 3 staff with the rank of Sergeant or Lieutenant. The presentation may require a Captain or Chief.

2.11 Strategy: Develop and Implement an Enhanced and Integrated TravInfo® System

Objective: To collect, consolidate, and disseminate timely and accurate data for freeways and multimodal traveler information for travelers and public agencies. MTC will be upgrading TravInfo® over the next four to six years to include a data collection system to complement Caltrans' TOS data collection system, integration of data from others, and data dissemination devices including a dial-in phone line, a web server interface, and kiosks. TravInfo®'s capabilities will be expanded so that it can serve as a hub for real time exchange of video images and traffic data (volumes, speeds, incident log and status reports, etc.) between the Regional TMC and Smart Corridors.

Action Plan: The current TravInfo® enhancement will serve as a data collector, consolidator, and disseminator of freeway conditions to enable travelers to make informed decisions about their travel and enable regional and local agencies to better manage Freeway Operations. TravInfo® serves as an important source for freeway and multimodal traveler information in the Bay Area – for travelers as well as for agencies in the region. Integrating TravInfo® with the other regional and local agencies will ensure that this information is accurate and comprehensive on a regional level. TravInfo® also will be able to provide valuable volume and incident data to the other agencies to improve traffic and incident management on Bay Area freeways. This information can also be shared with the public via private partner services. Foreseen actions include:

- Develop the updated TravInfo[®] system with NTCIP-compliant interfaces so that the system will be compatible with the TMC, CHP CAD and other regional systems.
- Participate in the Freeway Operations Center-to-Center Working Group to ensure that this system continues to serve the needs of the regional and local agencies in the Bay Area.

Lead Agency: MTC is the lead agency in this effort.

Schedule of Activities: The ongoing TravInfo[®] upgrades will occur over the next four to six years.

Resources: Staff from the MTC will lead the effort while participating agencies including Caltrans and CHP will also need to allocate some time. Funding for this action is identified in the 2002 Regional Transportation Plan. .

2.12 Strategy: Develop Regional ITS Architecture

Objective: To develop a comprehensive Regional ITS Architecture to ensure compatibility between systems as well as sharing of data between appropriate institutions. The architecture development process helps identify opportunities for integration and where standards are needed. The process also helps identify where interagency agreements may be necessary to improve interagency coordination. The portion of the Regional ITS Architecture for Freeway Operations was developed as part of the Concept of Operations Strategic Plan, and will be incorporated into the Regional ITS Architecture.

Action Plan: This planning effort, which is currently underway, will provide a framework from which all regional and local agencies can build their respective ITS systems. The regional architecture is developed early in the planning process so that outputs from the process can be used by agencies in defining related systems and subsystems. For a region such as the Bay Area that has been dealing with traffic management for a number of years, the regional architecture serves to formalize many of the tools and techniques already in place. It also will provide a forum for developing improved mechanisms to integrate and enhance traffic management actions. The following steps are anticipated:

1. **Near-Term Action: Regional ITS Architecture (Efficient Operation Initiative):** Develop Regional ITS Architecture: Consistent with Federal requirements, an ITS Architecture for Freeway Operations has been developed as part of the Freeway Concept of Operations project. MTC is leading the effort to develop a comprehensive Regional ITS Architecture for the Bay Area that will follow the National ITS Architecture model. Key steps include the following:
 - Phase 1 of the Regional ITS Architecture, the “State of ITS In the Bay Area”, will be completed in July, and Phase 2, the Regional ITS Architecture and Integration/Deployment Plan, will be completed in 2003/04.
 - The ITS Architecture for Freeway Operations developed as part of the Concept of Operations will be incorporated into the Regional ITS Architecture. These two efforts (the freeway architecture and the Regional ITS Architecture) must be thoroughly coordinated.
 - The Regional ITS Architecture will meet the requirements to receive ITS project funding from the Highway Trust Fund. As part of FHWA’s Final Rule for applying the National ITS Architecture at the Regional Level (January 8, 2001), funding for ITS projects will require that a Regional ITS Architecture be developed by April 8, 2005. By having a regional architecture in place, as well as conforming to applicable standards per FHWA’s rule, the Bay Area will be in compliance.

Lead Agency: The Metropolitan Transportation Commission is the lead agency in this effort. Continued participation by regional and local agencies is essential.

Schedule of Activities: The first phase of the Regional ITS Architecture will be completed during the summer of 2003, and the second phase will be completed in 2003/04.

Resources: Staff from the MTC will be responsible for this effort. A consultant is currently assisting with development of the Regional ITS Architecture. No further resources are necessary for completion of the Regional ITS Architecture.

2.13 Strategy: Establish Staffing and Funding Program

Objective: To develop a staffing and funding program for agencies in the Bay Area to ensure adequate resources are in place to support the level of regional Freeway Operations that is needed. This is a key issue with regard to ongoing TOS operations and maintenance (including the TMC), CHP and the new CAD system that is needed, and MTC's ongoing operation of the Freeway Service Patrol, call boxes, and TravInfo®. There also are funding and staffing issues regarding operations by the local agencies.

Action Plan: A staffing and funding program will ensure that these resources are primary considerations when looking at existing system operations and maintenance, as well as future expansion of system capabilities and geographic coverage, and that they are factored in with capital costs as part of the overall programming processes. Any gaps between infrastructure requirements and available staff and funds to maintain and operate the infrastructure will be identified. This also will allow staffing and funding to be approached on a regional level, and perhaps identify some opportunities for resource sharing to continue to operate, maintain, integrate, and enhance Freeway Operations systems. The anticipated steps are:

1. Staffing and Funding Requirements (System Sustainability Initiative): Develop a summary of the existing and programmed Freeway Operations system for the Bay Area. Define the resources required for maintenance and operation for existing and programmed systems to provide a detailed picture of the needed resources. This step will focus on the Caltrans and MTC programs.
 - Document the existing operations and maintenance resources available to Caltrans and MTC. This information should be formatted similar to that information developed in Step 1 above. Compare and contrast the existing resources to the necessary resources; identify shortfalls as noted.
 - Identify the levels of staff and funding that are needed to sustain current operations, and anticipated staffing and funding requirements for programmed enhancements as well as the completed systems. Formulate a phased staffing and funding program that also considers O&M requirements (as outlined in a separate Action Plan in this report).
 - Estimate the revenue stream that will be needed to fund the shortfall. Consider means to balance the long-term funding and staffing needed to support future regional Freeway Operations activities in the Bay Area.

Lead Agency: MTC should take the lead on this effort with Caltrans as an equal partner. Depending on staff availability within MTC and Caltrans, it may be advisable to retain the services of a consultant to perform the research, analyses, and report preparation.

Schedule of Activities: Work on the staffing and funding program should begin as soon as the TOS/TMC maintenance program is completed. At least six months should be allotted for completion of this Action Plan.

Resources: MTC and Caltrans will need to allocate staff time for this effort. MTC and Caltrans will need to allocate approximately one FTE each for six months working 60 hours per month to guide this effort. Assuming a consultant is retained for this project, staff demands can be minimized. Development of a plan of this type by a consultant is estimated to cost \$150,000.

2.14 Strategy: Integrate Incident Data

Objective: To better integrate data from freeway incident detection systems and identification systems operated by the various agencies in the Bay Area. The Regional TMC uses incident detection algorithms that process loop detector and RTMS data to identify potential incidents. TravInfo® relies on incident reports coming into the TMC, incidents reported by CHP through their CAD system, (these incidents include those reported through the call boxes, freeway service patrols, 911), and other sources. Emergency calls come in through a variety of sources, depending on whether it's a landline or wireless call. Landline 911 calls go directly to the respective jurisdiction for response and local agencies can forward the call to the appropriate agency (such as to the CHP dispatch center if it is a freeway traffic-related emergency). All cell phone 911 calls are directed into the CHP dispatch center, and it is CHP's responsibility to determine the location and nature of the emergency and forward the call to another jurisdiction or entity if appropriate. Call box calls go through the call box answering center (run by a contracted, private company), and 60% of those calls are routed to CHP.

Action Plan: This action plan will combine the data from these different reporting methodologies and different sources for incoming incident information into one integrated incident database. This will result in both a real-time information management system as well as a data archiving system. The work items in this action plan are geared toward documenting the variety of ways in which incidents are currently identified (by whom and using what means) and then developing an approach that allows all parties to gain the incident information in a concise and orderly way.

1. **Integrate Incident Detection (System Integration Initiative):** TravInfo® staff currently collect and manually consolidate reports of freeway incidents that affect freeway congestion. This action will develop a more automated and integrated system to collect incident detection data from several agencies and sources, integrate the data to combine multiple reports of a single incident, and concisely report accurate data to all involved agencies.
 - Initially identify incident detection information sources and the attributes of that data. This effort would be directed at the technologies used for incident detection as well as the agencies that own/operate those technologies. Collect sample data from all sources including FSP, detector data from TOS, and incident data from CHP CAD and call boxes.
 - Clarify and document the information that is needed by each agency for an incident. (e.g., location, number of vehicles, severity of incident, contact information, and type of emergency response needed).
 - Analyze the information sources and compare the collected data with the stated requirements. Identify missing data, as well as data that may be duplicated. Investigate format of data and assess whether consistency issues exist and need to be addressed.
 - Look for means to modify data sources that do not provide the desired type, configuration, or amount of data. Prepare a listing of the actions that would need to be taken in order for the integration goals to be achieved.
 - Investigate whether a central GIS-based system can be used to compile and track incident reports from various sources, and provide a cross-checking mechanism to verify incident information. In such a system, when an incident is reported by numerous sources, the details will only show up once in the system with a number that indicates how many times the incident was verified.

- Prepare a functional description of the attributes of the recommended integrated incident data manager. This is expected to be a software-development oriented narrative that will serve as a basis for future software design and system development efforts.
- Develop a schedule for system implementation and integration and sources of funding. The findings and recommendations will be incorporated into Action Item No. 13, *Establish Staffing and Funding Program*.
- Assess where the integrated incident database management function could or should reside and who would be responsible for its health and well being. This could be somewhat akin to deciding who owns the Internet, but ownership and responsibility for this functionality is critical to the success of the integration goals.

Lead Agency: Caltrans should be the lead agency for developing the automated incident integration system within the TMC software. Support from selected local agencies, primarily law enforcement and emergency services, will also be needed. Consideration should be given to formation of a technical advisory committee for this project.

Schedule of Activities: Approximately twelve months should be allotted to the development of the Incident Data Integration Plan System. This time frame is contingent on the schedule and level of involvement of the task force, as well as the complexity of the plan that emerges.

Resources: Staff from Caltrans and from participating agencies including MTC and CHP will need to allocate time for this effort. Development of the Incident Data Integration Plan is expected to entail \$275,000 in consultant assistance.

2.15 Strategy: Ramp Metering Outreach

Objective: To start a dialog between Caltrans and local agencies about the potential benefits of ramp metering, and operational strategies that could accommodate corridor-specific issues and improve freeway and arterial operations. The current approach to a ramp metering policy is to adapt the Caltrans policy to local agencies' needs. Caltrans generally wants to optimize Freeway Operations, and local agencies typically are concerned that ramp metering will restrict their access to the freeway and interfere with local traffic flow, while providing a benefit to longer distance commuters. An informed discussion of the various strategies for ramp meter operations needs to precede decisions on where and when to implement ramp metering in the Bay Area.

Some local agencies have indicated the desire for policies regarding the coordination of ramp meters with nearby traffic signals on arterials. Some cities have Letters of Understanding to permit Caltrans to operate the traffic signal at the freeway ramp terminal and the next nearest signal. Not all cities have such agreements with Caltrans in place and some lack coordination between ramp intersection signals and adjacent city signals, thus inhibiting smooth traffic flow on city streets.

Action Plan: This effort will result in increased dialogue among Caltrans and local agencies regarding current ramp meter operations and issues. It will also provide the means for a consistent approach to ramp metering on a regional level. The following steps are anticipated:

1. Ramp Metering Outreach (System Integration Initiative): Establish a technical working group comprised of representatives from the Bay Area's regional agencies, cities, and counties to discuss the potential operational benefits of ramp metering. Define the range of metering strategies (fixed time operation, demand responsive, corridor-level coordination, etc.) and their effects on freeways, ramps, and arterials.
 - Investigate the feasibility of a regional ramp metering policy that would be consistent with statewide policy and accommodate the needs and desires of various corridors in the

Bay Area. Determine pros and cons of such an arrangement for local agencies as well as Caltrans.

- Obtain consensus on the benefits of ramp metering, potential operational strategies and scenarios, and the roles of local and regional agencies in the effective implementation ramp metering.

Lead Agency: Caltrans should be the lead agency in this effort. Active participation by the regional and local agencies will also be necessary.

Schedule of Activities: Approximately twelve months should be allotted the ramp metering dialog in the Bay Area.

Resources: Caltrans and participating regional and local agencies will need to allocate staff time for this effort. Caltrans will need to allocate approximately one FTE professional working 60 hours per month for twelve months for this effort. Consultant assistance totaling \$100,000 is recommended.